

Frosts occurred in the Gulf and South Atlantic States, as follows, viz, on the 3d light frosts in the southern and heavy in the northern portions of Alabama and Mississippi; on the 4th heavy frosts in Alabama, Mississippi, and Georgia, and light in northern Florida; on the 13th light frosts in North Carolina, South Carolina, and northern Florida; on the 17th killing frosts in northern Louisiana and Mississippi; on the 18th light frosts on the Gulf and south Atlantic coasts, and killing in the central portions of the Gulf States and in North Carolina. Warnings of these frosts were issued in every case twenty-four hours, and in some cases forty-eight hours, in advance.

On Tuesday, the 16th, a special bulletin issued by the Bureau announced that—

The most decided cold wave of the season is indicated for Wednesday morning throughout the yellow fever districts of the South.

Freezing weather probably will occur throughout the northern and central portions of the Gulf States and in the Ohio Valley Wednesday morning, and frosts generally throughout the Southern States Wednesday and Wednesday night.

And the observer at New Orleans was directed to warn postmasters in the sugar regions of the probable occurrence of freezing weather in the western portion of those districts.

#### COMMENTS OF THE PRESS.

The following remarks in regard to the warnings of cold waves issued by the Bureau are extracted from the respective newspapers:

*Journal, Sioux City, S. Dak., November 22, 1897.*—Warnings of these sudden changes of temperature are widely distributed by the Weather Bureau, and are of immense value to all classes of business. The distribution is made through the medium of the newspapers, the telephones, the telegraph, and by means of special bulletins. In Sioux City the two telephone exchanges have about 1,700 subscribers. The central offices receive cold weather warnings from the observer and notify all subscribers who wish such notification. The number taking these warnings is large, consisting largely of commission men, railroad officials, and others having to do with perishable products. If a commission man has perishable freight en route when a cold wave warning is issued he orders it into a roundhouse or other warm building until the danger is past, or he refrains from shipping until the weather becomes more favorable; and, again, the warning is of great value to him in his local business, as certain kinds of fruit can not be exposed to a cold wind without injury.

The value of cold wave and frost warnings is mentioned by the Chief of the Weather Bureau in his annual report for 1896. He says: "Particular attention is called to the cold wave of unusual severity that overspread nearly the entire United States east of the Rocky Mountains on January 2 to 5, 1896. Warnings of this wave were sent at least twenty-four hours in advance to nearly every station in its path. The Weather Bureau observers at the stations visited by the cold wave report an estimated saving on account of the warnings of over \$3,500,000. The estimate, from the nature of the case, could be a partial one only. It is interesting to note the variety of industries benefited. Owners and shippers of perishable produce protected their property from injury by frosts or freezing; owners of residences, factories, and distilleries, and custodians of hospitals and public buildings protected water pipes to prevent bursting; railway officials regulated the size of trains; florists and truck growers protected their hot-houses and growing crops; farmers in the south slaughtered their cattle and hogs; river men protected their boats and stock raisers their cattle. In the State of Florida alone, where a large quantity of early garden truck was above ground, the actual figures given by the truck raisers themselves showed a saving by this warning of over \$300,000, and this was necessarily only a partial estimate."

The appropriation for the maintenance of the Weather Bureau is about \$900,000 per annum, so it will be seen that the saving by reason of this one warning was sufficient to pay the cost of the whole Bureau for a year several times. "This estimated saving is not a wild guess," said Mr. Fursell. "It is not made by the observers, but by the business men themselves, by the men who are liable to loss from sudden changes in temperature. As the report of the Chief says, it is but a partial estimate, and very likely is a good deal short of the amount actually saved. It illustrates, however, the value of the Bureau and its warnings to the business interests of our country."

*The Evening Star, Washington, D. C., November 18, 1897.*—Many colds have been "caught" by imprudent ones who did not give full credence to the warning given by the Weather Bureau Tuesday that it would be "decidedly colder" Wednesday morning. This warning was amply justified, and its success should encourage some skeptics to place more

faith in the forecasts of this branch of the Government service, which works under so many handicaps and with such elusive elements."

In regard to the forecasts and warnings issued during the month for Montana, probably one of the most difficult districts for which to make accurate forecasts, because it is so near the border of the region of observations, the Observer at Havre reports:

More than usual interest has been manifested by the residents in this vicinity, in the daily weather forecasts, during this month (November). With but one exception, the 8th instant, the forecasts for Montana have been so thoroughly verified in this neighborhood that no improvements could be made unless the public should want the exact hours, etc., when the expected weather changes would take place.

The cold-wave warning, forecasts of warmer to-night, rising temperature, snow, continued cold, etc., were all verified to the letter. The warning of the cold wave on the 19th was distributed by extra copies of bulletin, Form No. 1036—Met'l, and cold-wave flag displayed. Special forecast of "High winds, snow, and much colder to-night," Sunday, November 14, was distributed in hotels, open business houses, and elsewhere, and flags displayed.

#### AREAS OF HIGH AND LOW PRESSURE.

By Prof. H. A. HAZEN.

During November the tracks of 7 highs and 8 lows have been sufficiently well defined to be traced, and are charted on Charts I and II. The following table shows the date and place of origin and disappearance and the duration and velocity of apparent translation of each high and low.

#### Movements of centers of areas of high and low pressure.

Number.	First observed.			Last observed.			Path.		Average velocities.	
	Date.	Lat. N.	Long. W.	Date.	Lat. N.	Long. W.	Length.	Duration.	Daily.	Hourly.
<b>High areas.</b>							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	29, p. m.	49	124	5, p. m.	47	80	4,580	7.6	594	27.3
II.....	1, p. m.	47	125	8, a. m.	31	80	5,280	9.5	505	21.0
III.....	6, a. m.	37	124	14, p. m.	34	76	4,100	9.5	432	20.1
IV.....	14, a. m.	54	118	22, a. m.	29	87	4,090	9.6	511	21.3
V.....	19, p. m.	54	115	26, a. m.	48	55	4,030	9.5	620	25.3
VI.....	27, a. m.	52	106	29, a. m.	47	62	2,590	9.6	563	26.0
VII.....	27, a. m.	50	114	30, p. m.	57	74	2,450	8.5	700	29.2
<b>Total.....</b>							25,120	43.0	4,335	.....
<b>Mean of 7 tracks.....</b>							3,589	.....	619	23.8
<b>Mean of 43 days.....</b>							.....	.....	584	24.3
<b>Low areas.</b>							<i>Miles.</i>	<i>Days.</i>	<i>Miles.</i>	<i>Miles.</i>
I.....	29, p. m.	54	106	3, p. m.	48	52	3,940	5.0	788	32.8
II.....	2, p. m.	44	102	7, p. m.	49	52	3,000	5.0	600	25.0
III.....	6, p. m.	38	99	10, a. m.	49	53	2,700	4.0	675	28.1
IV.....	9, p. m.	52	111	13, a. m.	47	56	2,850	3.5	570	28.8
V.....	11, a. m.	48	128	17, p. m.	46	55	3,970	6.5	611	25.4
VI.....	17, a. m.	47	127	22, p. m.	48	55	3,870	5.5	704	29.2
VII.....	20, a. m.	50	126	27, a. m.	48	67	4,000	7.0	571	25.8
VIII.....	23, p. m.	42	87	30, p. m.	46	58	1,610	2.0	805	33.5
<b>Total.....</b>							25,940	38.5	5,324	.....
<b>Mean of 8 tracks.....</b>							3,242	.....	665	27.7
<b>Mean of 38.5 days.....</b>							.....	.....	674	28.1

#### HIGHS.

The general tendency during the month has been for highs to begin or first appear to the north of Montana and take a general southeast track, disappearing off the south Atlantic Coast. Highs Nos. I, II, and III could be traced back to the Pacific Coast; the four last of the month were first noted in Alberta. The highest pressure and lowest temperature of the month occurred in connection with No. VI, on the morning of the 26th, when 31.02 inches and  $-32^{\circ}$  was experienced at Swift Current. The greatest change in temperature and severest cold wave occurred during the prevalence of high area No. V, to the north of Montana. The a. m. observation of the 20th showed a fall in temperature of  $46^{\circ}$  in twenty-four hours at Havre and of  $44^{\circ}$  at Helena. The next evening the fall at Helena was  $52^{\circ}$ , at Rapid City  $48^{\circ}$ , and at Bismarck  $42^{\circ}$ . By the morning of the 21st the fall at Rapid City was  $46^{\circ}$ , at Huron  $44^{\circ}$ , and at Pierre  $43^{\circ}$ .

### LOWS.

The general direction of the paths has been on a higher parallel of latitude than in the case of the highs. Lows Nos. V, VI, and VII began on the north Pacific Coast; Nos. I and

IV began to the north of Montana; Nos. II, III, and VIII began in the central valleys. All the storms, without exception, disappeared over Newfoundland or in the permanent low area of that region.

## CLIMATOLOGY OF THE MONTH.

By A. J. HENRY, Chief of Division of Records and Meteorological Data.

### GENERAL CHARACTERISTICS.

The month opened with an area of cloud and rain over the lower Mississippi Valley and Gulf States, a region, it will be remembered, in which heavy rains fell during March and April of the current year. Since that time no general storm has originated in or passed over the Gulf States. The rains in the interim have been light and sporadic, and the water in the rivers in many cases has reached as low a point as ever before recorded. At the close of the month there was a notable deficiency of precipitation over all of the country from the Carolinas southward and westward to Oklahoma and Texas. On the other hand, an abundance of rain fell in the Ohio Valley from Cairo to the lower Lake Region; also in New England and generally over the northern Pacific Coast, extending as far eastward as Montana.

Temperature was generally above normal, the only important exception being on the central and north Pacific Coast and over the northern plateau where it was below normal. Killing frost was general throughout Mississippi and Alabama on the 30th, and light to killing frost occurred at many points in Louisiana on the same date. Light frost occurred at New Orleans on the 18th and at Mobile on the 19th.

The first half of the month was an unusually stormy period in the Lake Region, but the number of storms during the last half was not greater than the average for the season.

The most severe storm of the month prevailed on the north Pacific Coast from the morning of the 17th to the morning of the 19th. The anemometer at the Fort Canby station registered 2,380 miles of wind, an average velocity of 63 miles per hour between 11 p. m. of the 16th and 2 p. m. of the 18th, thirty-eight consecutive hours. The wind blew with the greatest velocity (over 70 miles per hour) during the last six hours of the storm's duration.

Some damage was done by the wind at inland points, but the greatest destruction was occasioned by floods in small streams and rivers. Railroad travel was greatly interrupted by landslides, washouts, and destruction of bridges. Fortunately a fall in temperature on the 20th checked what might otherwise have been a very destructive flood throughout Washington and Oregon.

### ATMOSPHERIC PRESSURE.

[In inches and hundredths.]

Pressure was below normal over practically the whole Plateau Region and the north Pacific Coast, the greatest deficit being at Walla Walla, Wash. Elsewhere it was above normal, especially in Assiniboia and Manitoba.

The distribution of mean atmospheric pressure reduced to sea level, as shown by mercurial barometers, not reduced to standard gravity, and as determined from observations taken daily at 8 a. m. and 8 p. m. (seventy-fifth meridian time), is shown by isobars on Chart IV. That portion of the reduction to standard gravity that depends on latitude is shown by the numbers printed on the right-hand border.

The numerical values of Table I should be consulted for additional details.

### TEMPERATURE OF THE AIR.

[In degrees Fahrenheit.]

Except in the upper half of California, the northern portion of Oregon, thence northward to the boundary line and eastward to Lake Superior, November was warmer than usual. The departures from the normal were not great in any district save over north-central Montana where the average daily deficit was about 10°. There were no very severe cold waves, and the month as a whole presented no striking features as regards temperature.

The mean temperatures and the departures from the normal, as determined from records of the maximum and minimum thermometers, are given in Table I for the regular stations of the Weather Bureau, which also gives the height of the thermometers above the ground at each station. The mean temperature is given for each station in Table II, for voluntary observers.

The *monthly mean temperatures* published in Table I, for the regular stations of the Weather Bureau, are the simple means of all the daily maxima and minima; for voluntary stations a variety of methods of computation is necessarily allowed, as shown by the notes appended to Table II. The mean temperatures given in Table III for Canadian stations are the simple means of 8 a. m. and 8 p. m. simultaneous observations.

The *regular diurnal period* in temperature is shown by the hourly means given in Table V for 29 stations selected out of 82 that maintain continuous thermograph records.

The *distribution of the observed monthly mean temperature* of the air over the United States and Canada is shown by the dotted isotherms on Chart IV; the lines are drawn over the Rocky Mountain Plateau region, although the temperatures have not been reduced to sea level, and the isotherms, therefore, relate to the average surface of the country occupied by our observers; such isotherms are controlled largely by the local topography, and should be drawn and studied in connection with a contour map.

The *years of highest and lowest mean temperatures* for November are shown in Table I of the Review for November, 1894. The mean temperature for the current month was neither the highest nor the lowest on record at any regular station of the Weather Bureau.

The *maximum and minimum temperatures* of the current month are given in Table I. The highest maxima were: 92, Los Angeles (18th); 88, Yuma (2d), Phoenix (19th); 86, Corpus Christi (8th), San Antonio (11th); 85, Jupiter (1st); 84, Abilene (3d), Palestine (15th), Dodge City (20th). The lowest maxima were: 49, Marquette (3d); 54, Sault Ste. Marie (3d), Fort Canby (18th); 55, Eastport (6th); 56, Duluth (2d); 57, Portland, Me., (4th); 59, Detroit (frequently). The highest minima were: 67, Key West (4th); 58, Jupiter (3d); 50, Tampa (13th); 49, Port Eads (2d). The lowest minima were: -26, Miles City (28th); -21, Havre (28th); -19, Williston and Huron (29th).

The *years of highest maximum and lowest minimum temperatures* for November are given in the last four columns of Table I of the Review for November, 1896. During the current month the maximum temperatures were equal to or above